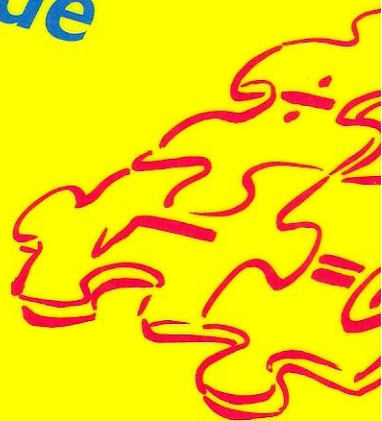


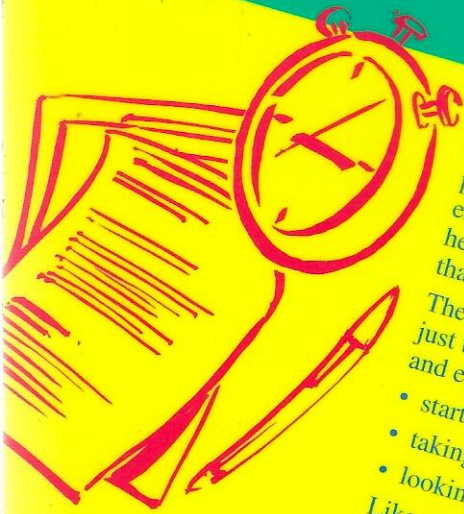


The Sciences Good Study Guide



*Andrew Northedge,
Jeff Thomas, Andrew Lane
and Alice Peasgood*

The Sciences Good Study Guide



The Sciences Good Study Guide is indispensable for students of mathematics, science, technology and engineering. Packed with practical exercises and activities, it aims to make studying more enjoyable and rewarding. It's an invaluable source of 'hints and tips', helping you to learn more effectively and develop study strategies that really work.

The book is designed to meet the needs of a range of learners – not just those involved in distance education. It will appeal to beginning and experienced students alike, including those:

- starting to study at college or university
- taking access/study skills courses
- looking afresh at how they study.

Like no other book, *The Sciences Good Study Guide* offers you:

- opportunities to practise key study skills
- a Maths Help section
- guidance on how to approach practical work
- advice on how to manage your precious study time
- hints on how a computer can help you study.

The book starts from real-life situations and encourages you to build on familiar skills.

The Sciences Good Study Guide is based on feedback from students of The Open University and the university's extensive experience of teaching science, technology, mathematics and computing.

Comments on *The Sciences Good Study Guide* from experienced study skills teachers:

'Read it, work through it, and give serious consideration to the advice it offers – I defy you not to emerge a more effective learner.'

'The book is conceived to help students in a non-pompous and friendly way – it certainly succeeds. I wish it had been available to me as a student.'

'It will surely become the standard text for the numerous access/foundation year courses in FE and HE institutions.'

This is a set book for The Open University Science Foundation Course S103 *Discovering Science* and the second level course S280 *Science Matters*.


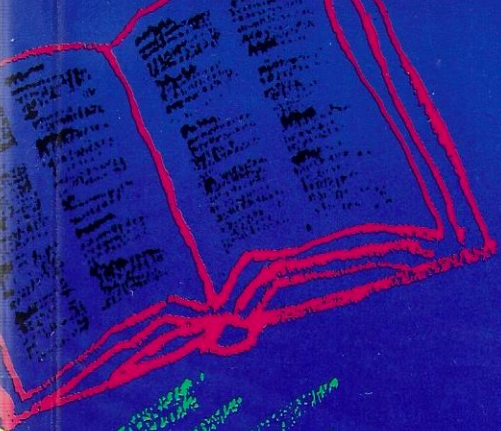


ISBN 0-7492-3411-3



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The Good Study Guide



Andrew Northedge





The Good Study Guide

Studying is one of the most challenging activities and one of the most satisfying; indeed it can change your life. But if you take the wrong approach it can be frustrating and disappointing. Whether you are new to study or more experienced, *The Good Study Guide* will improve your study skills by helping you to:

- read with concentration and understanding
- write fluently and forcefully
- develop a flexible note-taking strategy
- handle numbers confidently
- prepare effectively for exams.

The Good Study Guide can be used either as an introductory workbook, or as a reference book to help you refine your study technique. Using real-life examples and practical exercises, it is designed to meet the needs of social science and humanities students, including adults studying part-time, and anyone returning to study, perhaps after a long break. Students on access/set book courses will find it invaluable. It is a set book for the Open University Social Science Foundation Course.

Comments on *The Good Study Guide* from experienced study skills teachers:

'It is extremely readable in style and presentation, easily accessible to the less able student ... I just wish someone had given me this material when I started university! In fact I think I could still learn from it ...'

'It is truly a compulsively good read ... a beautifully crafted, customer-friendly, superb catalogue of really helpful advice.'

OPEN UNIVERSITY SET BOOK



ISBN 0-7492-0044-8

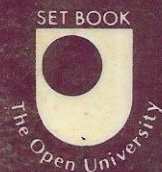


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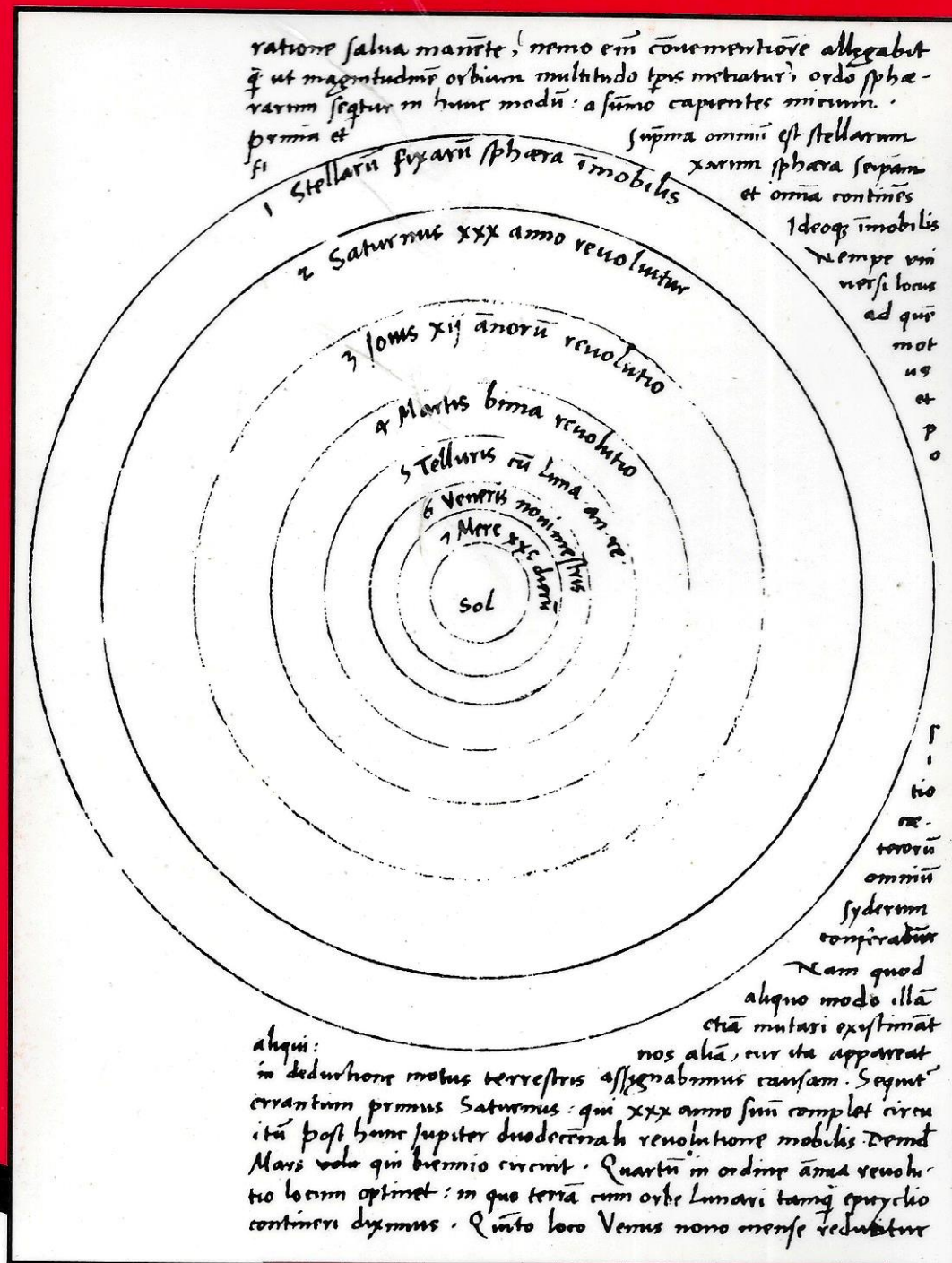
SCIENCE DATA BOOK

Edited by
R.M. Tennent



Oliver & Boyd

SCIENCE

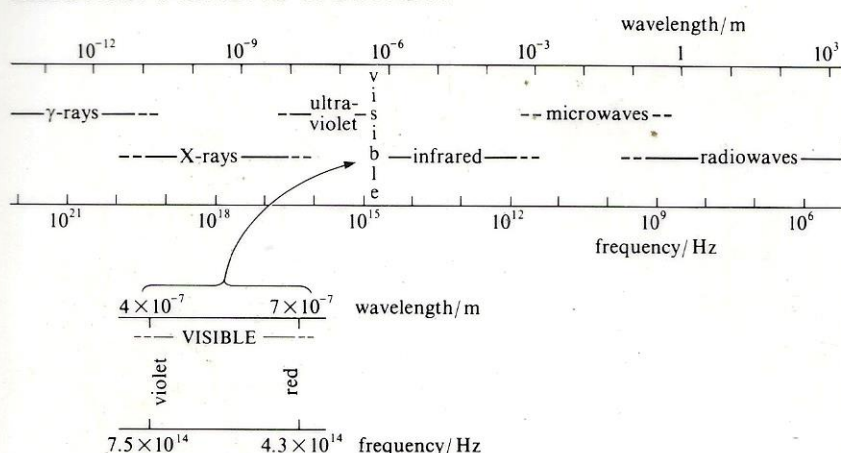


Unit 1
Science and the planet Earth

Unit 2
Measuring the Solar System

USEFUL INFORMATION FOR THE PHYSICS AND GENERAL SCIENCE UNITS

ELECTROMAGNETIC SPECTRUM



PHYSICAL CONSTANTS

Symbol	Quantity	Approximate value
G	gravitational constant	$6.672 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
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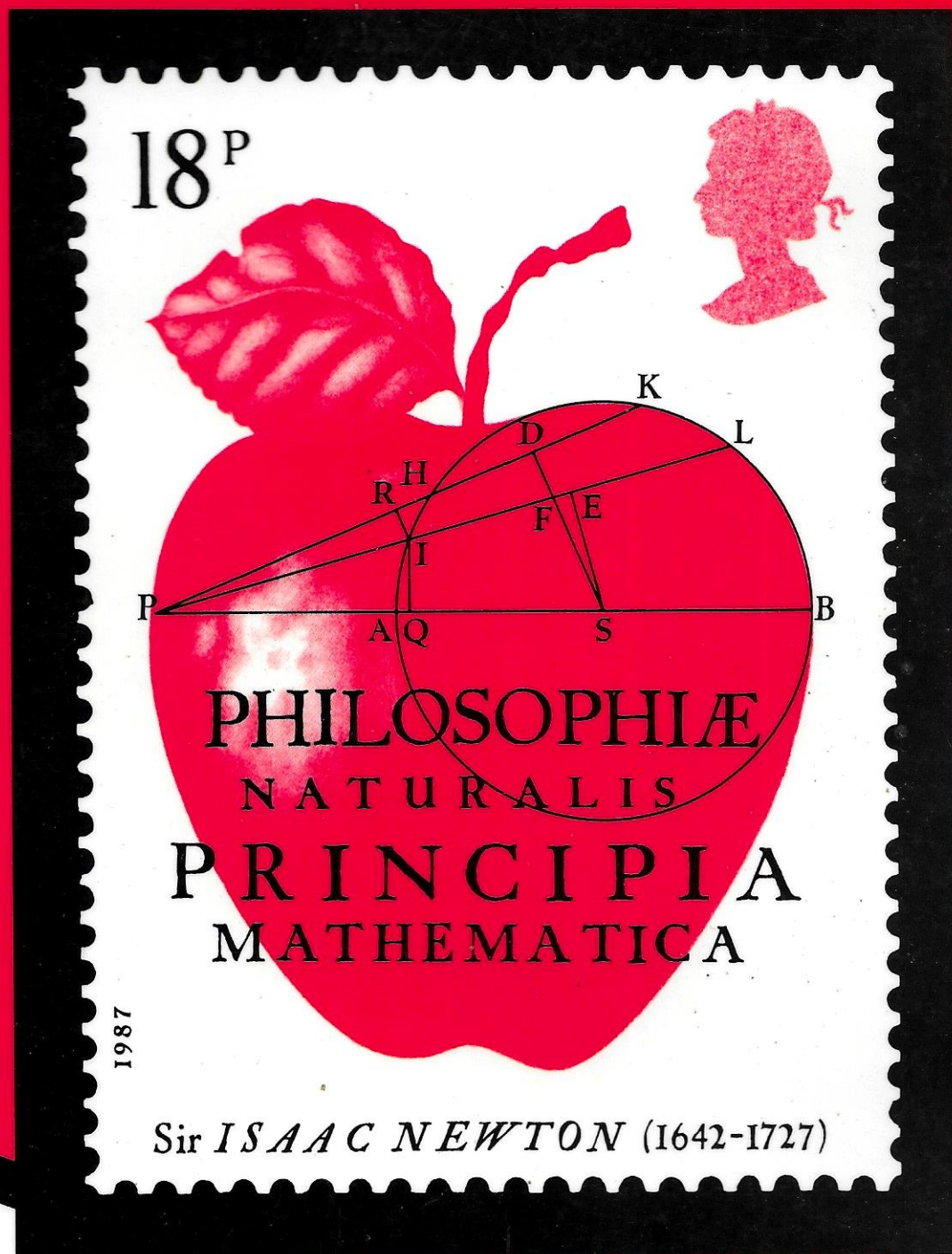
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1 radian $\approx 57.296 \text{ degrees}$	
1 degree $\approx 0.01745 \text{ radian}$	
1 GeV/c ² $\approx 1.783 \times 10^{-27} \text{ kg}$	

SI02 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
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SCIENCE

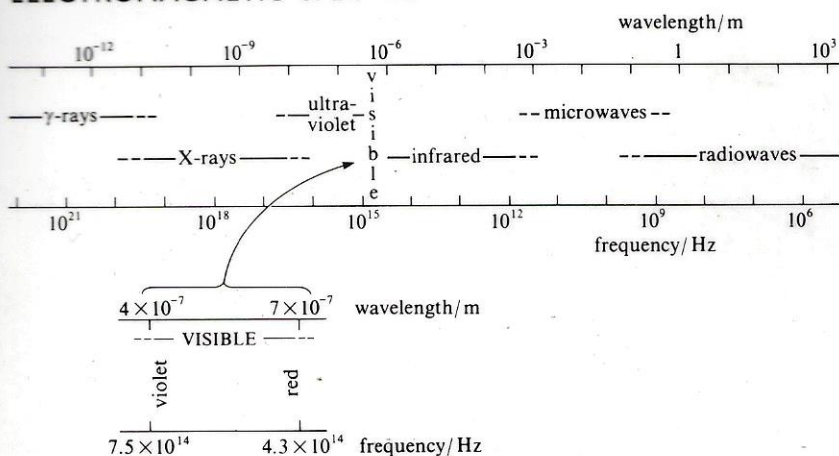


Unit 3
Motion under gravity

Unit 4
Practical work in science

USEFUL INFORMATION FOR THE PHYSICS AND GENERAL SCIENCE UNITS

ELECTROMAGNETIC SPECTRUM



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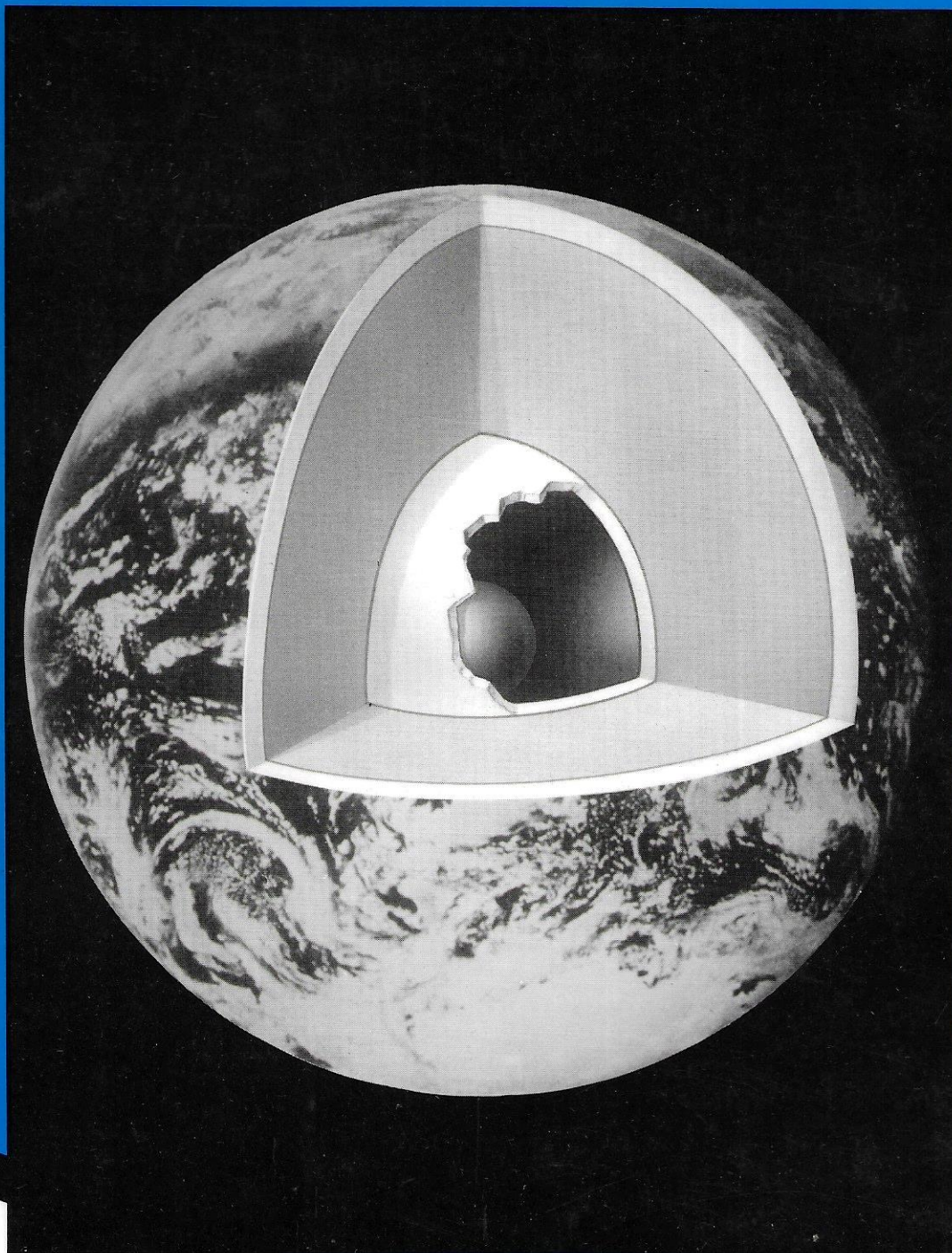
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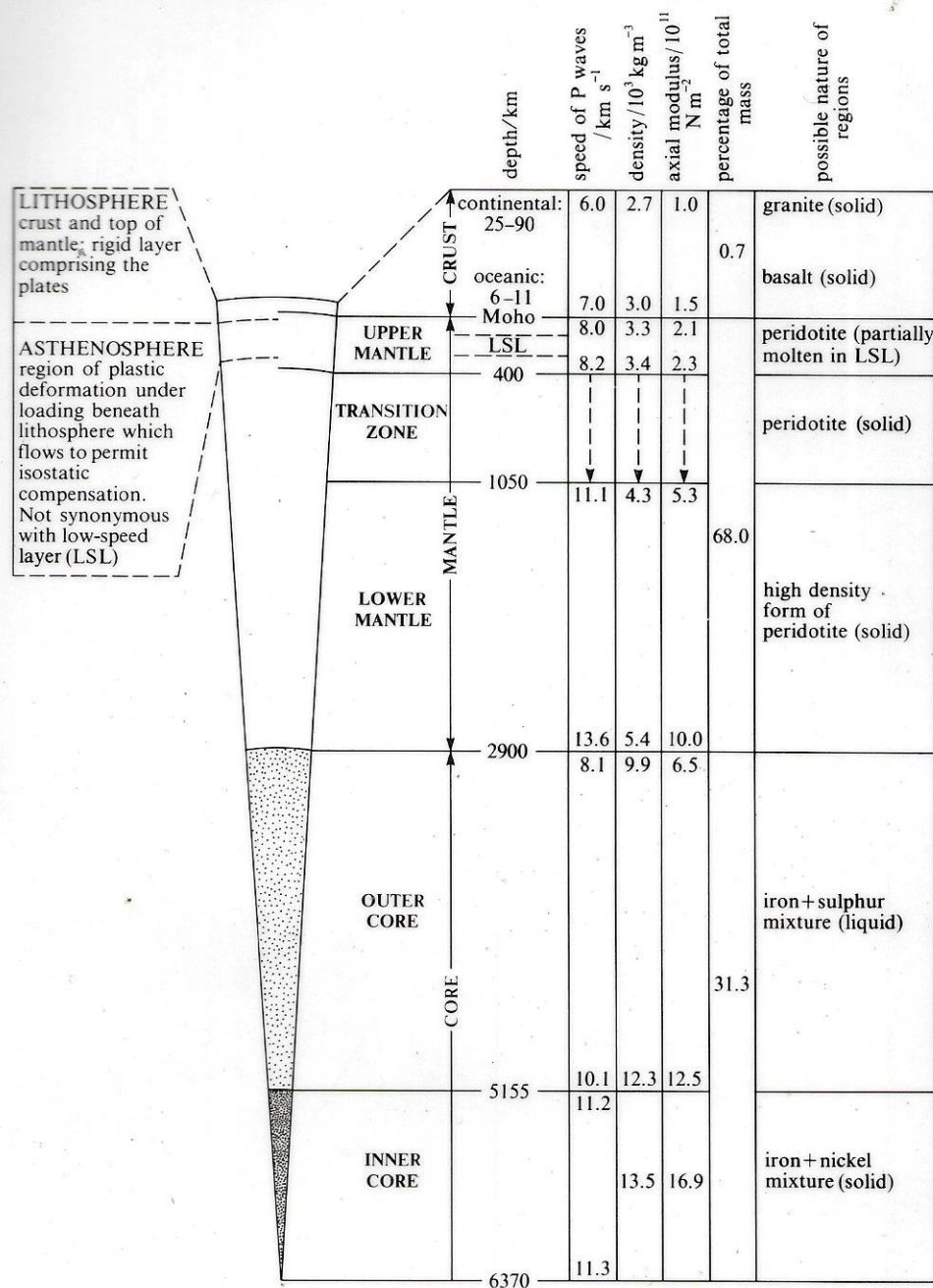


SCIENCE



Units 5-6
Into the Earth: earthquakes,
seismology and the Earth's magnetism

PROPERTIES OF THE EARTH'S INTERIOR

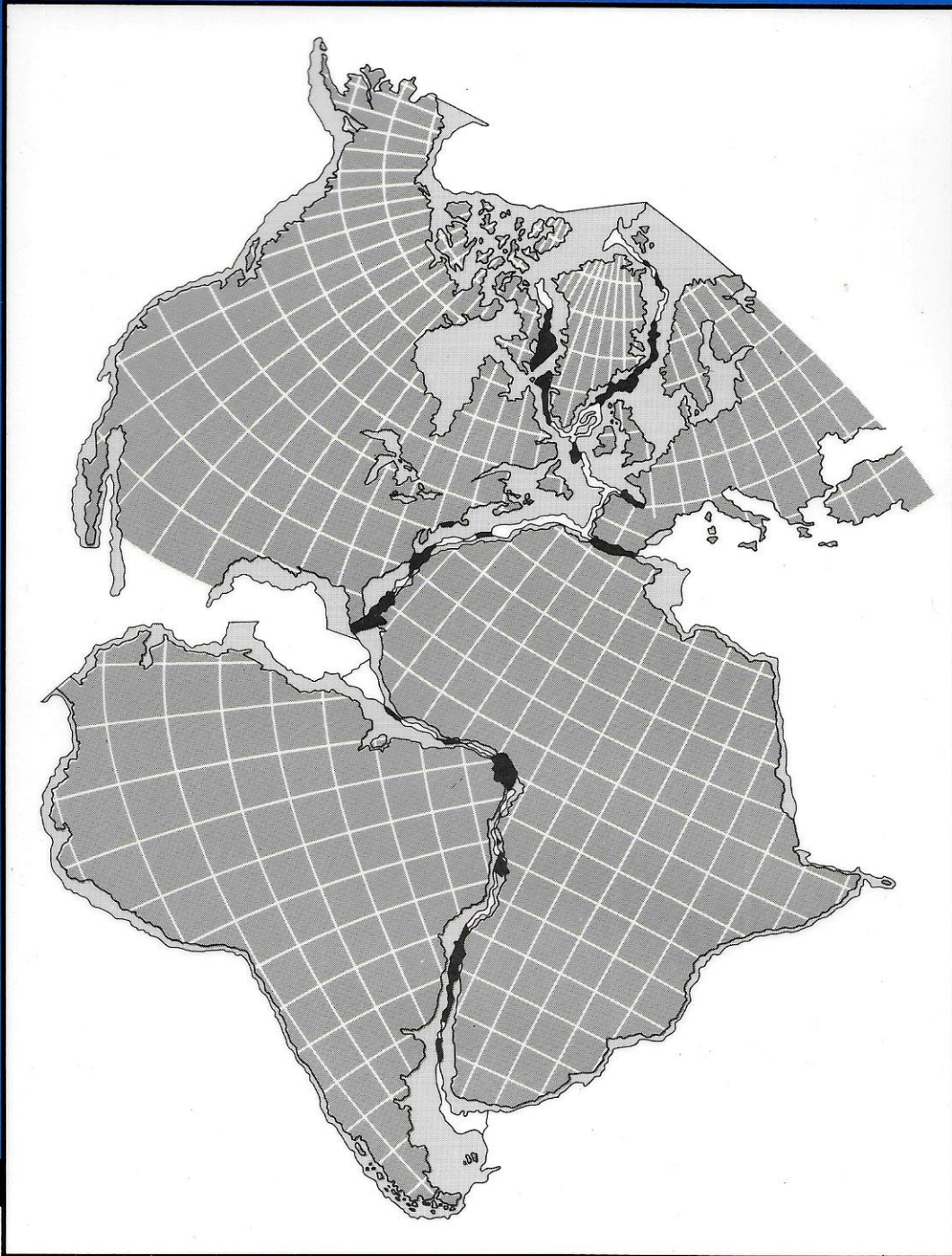


SI02 UNITS

- | | |
|---|---|
| 1 Science and the planet Earth | 19 Life and evolution |
| 2 Measuring the Solar System | 20 Inheritance and cell division |
| 3 Motion under gravity | 21 Genes and evolution |
| 4 Practical work in science | 22 Biochemistry |
| 5-6 Into the Earth: earthquakes, seismology and the Earth's magnetism | 23 Physiology |
| | 24 DNA: molecular aspects of genetics |
| 7-8 Plate tectonics: a revolution in the Earth sciences | 25 Ecology |
| 9 Energy | 26 Biology reviewed |
| 10 Modelling the behaviour of light | 27 Earth materials and processes |
| 11-12 Atomic structure | 28-29 Geological time and Earth history |
| 13-14 Chemical reactions and the Periodic Table | 30 Quantum mechanics: an introduction |
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| 17-18 The chemistry of carbon compounds | |

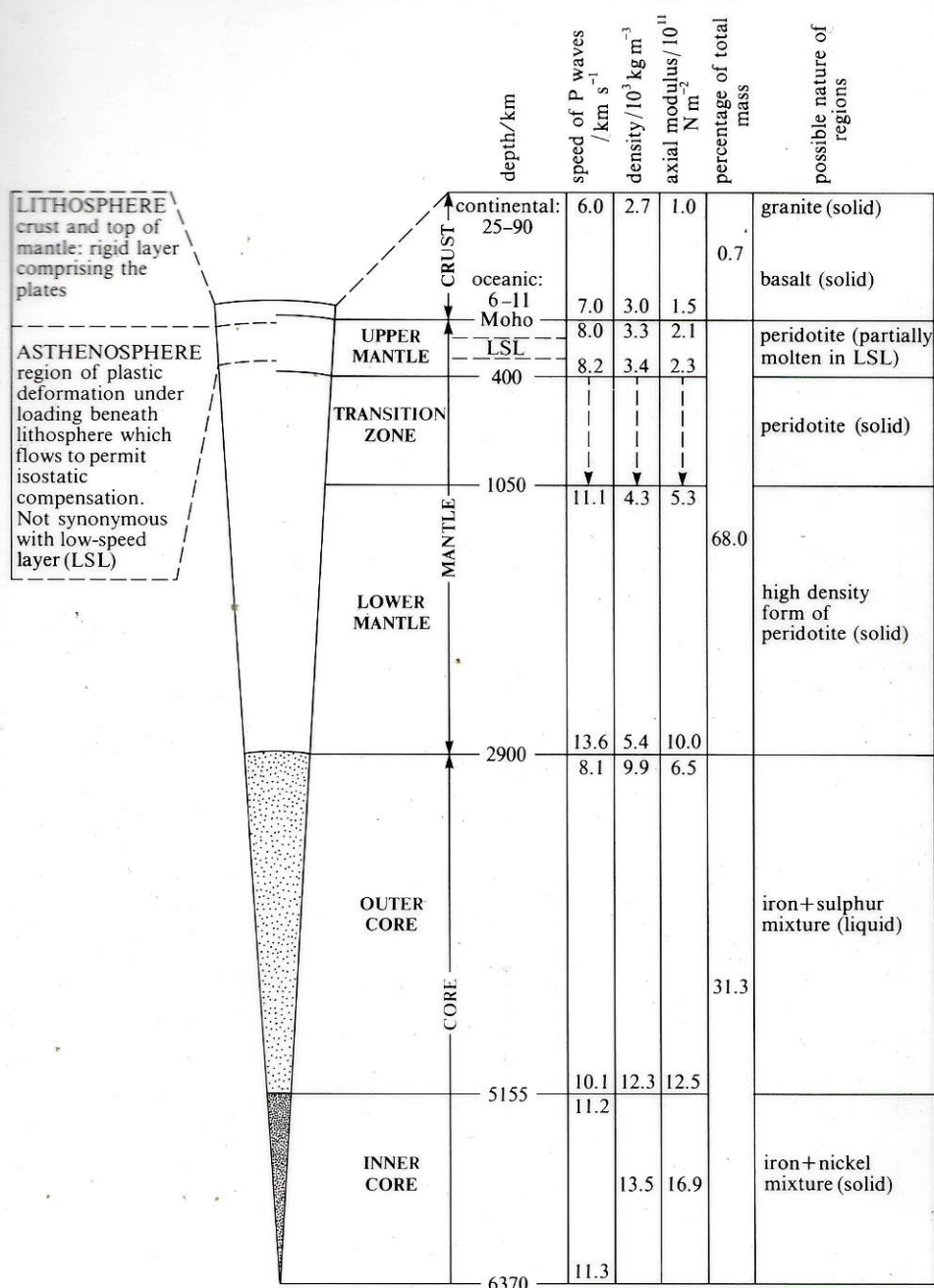


SCIENCE



Units 7-8
Plate tectonics:
a revolution in the Earth sciences

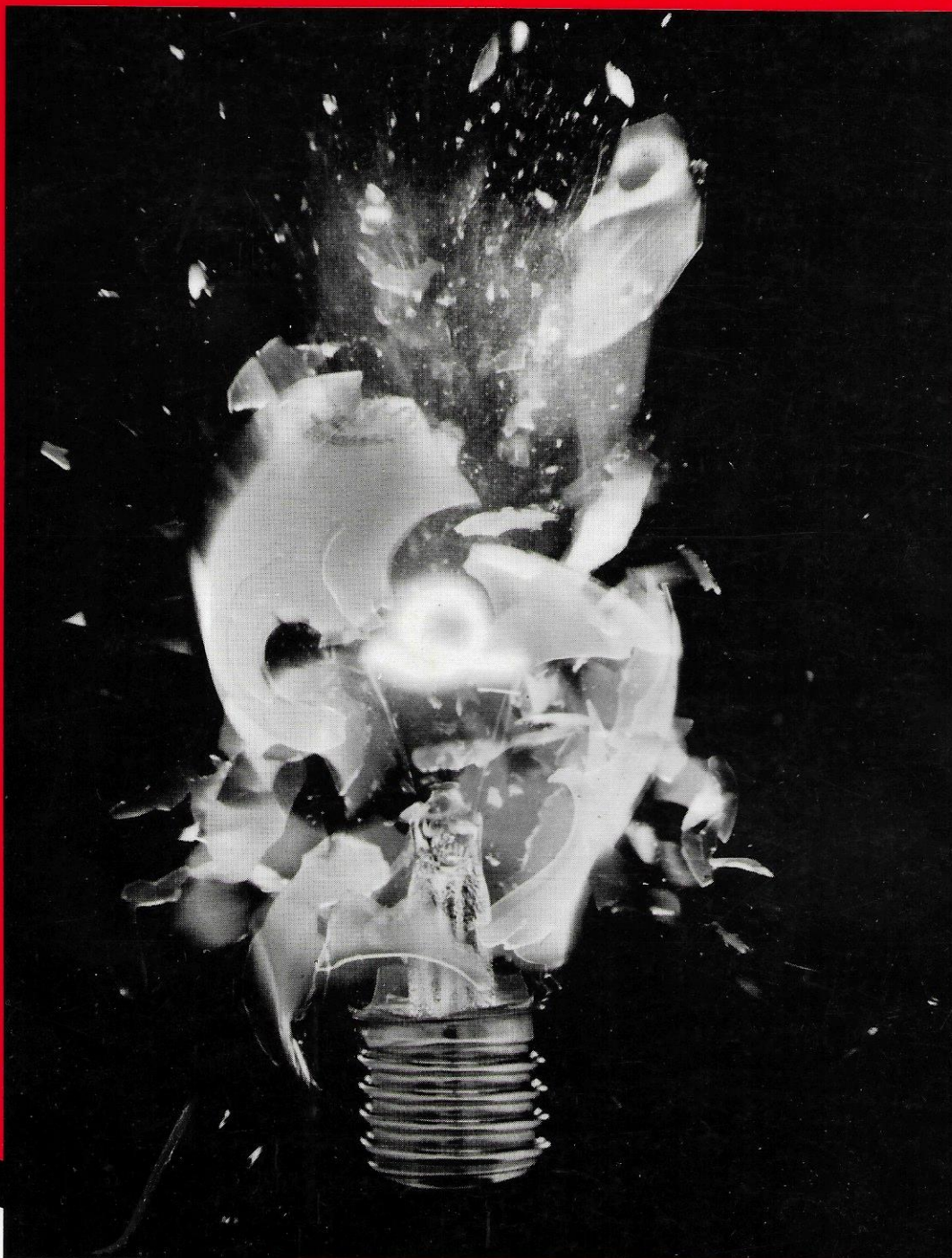
PROPERTIES OF THE EARTH'S INTERIOR



S102 UNITS

- | | |
|---|---|
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| 2 Measuring the Solar System | 20 Inheritance and cell division |
| 3 Motion under gravity | 21 Genes and evolution |
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SCIENCE

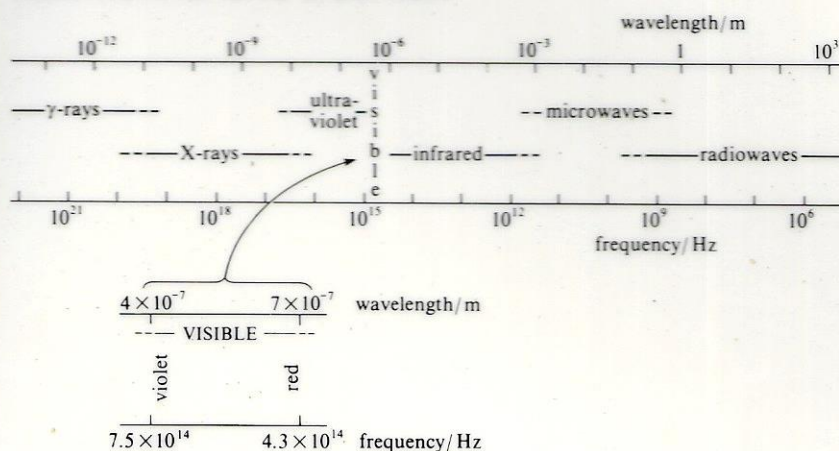


Unit 9
Energy

Unit 10
Modelling the behaviour of light

USEFUL INFORMATION FOR THE PHYSICS AND GENERAL SCIENCE UNITS

ELECTROMAGNETIC SPECTRUM



PHYSICAL CONSTANTS

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SI02 UNITS

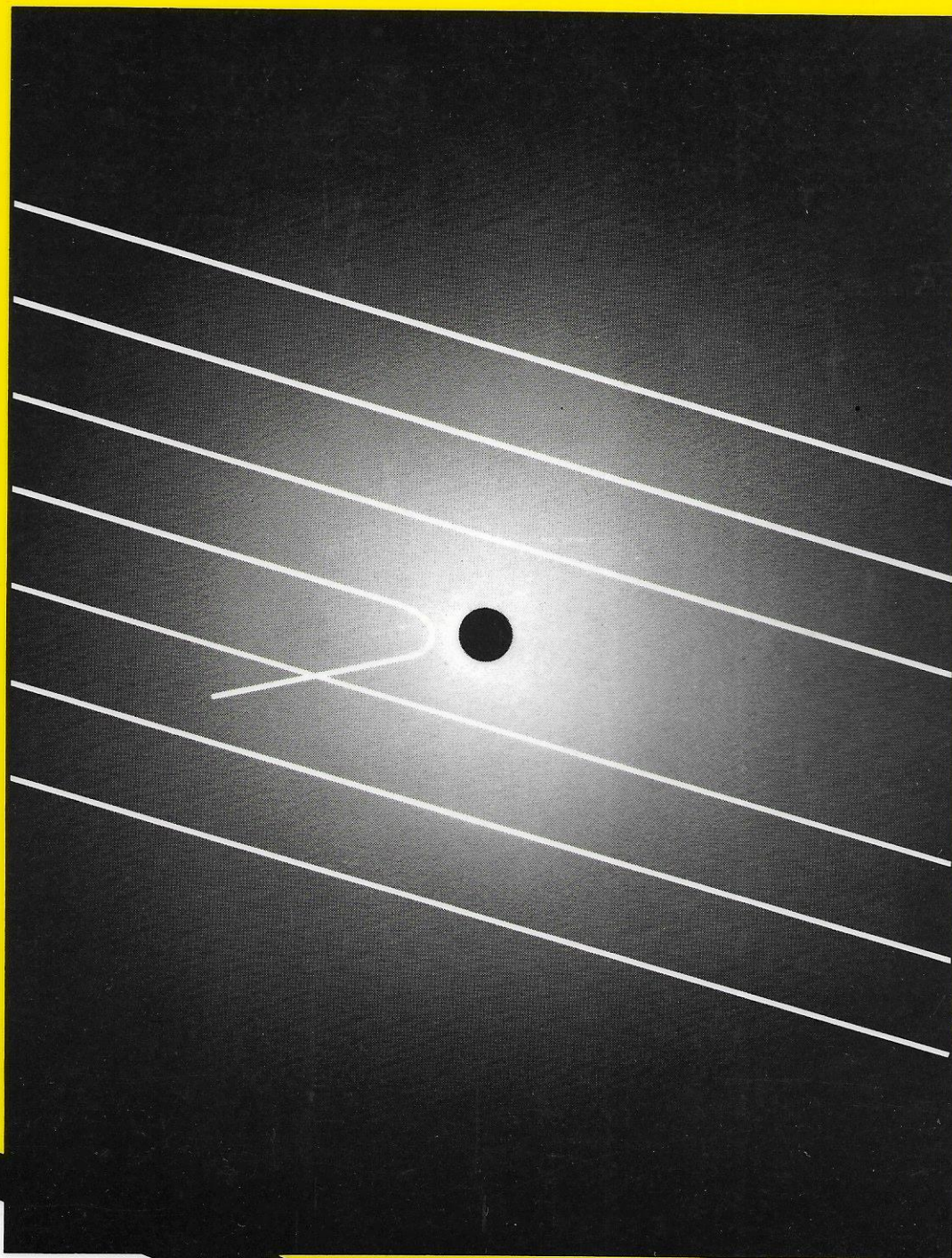
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17-18	The chemistry of carbon compounds		

SI02 UNITS 11-12

THE OPEN UNIVERSITY
SI02: A SCIENCE FOUNDATION COURSE



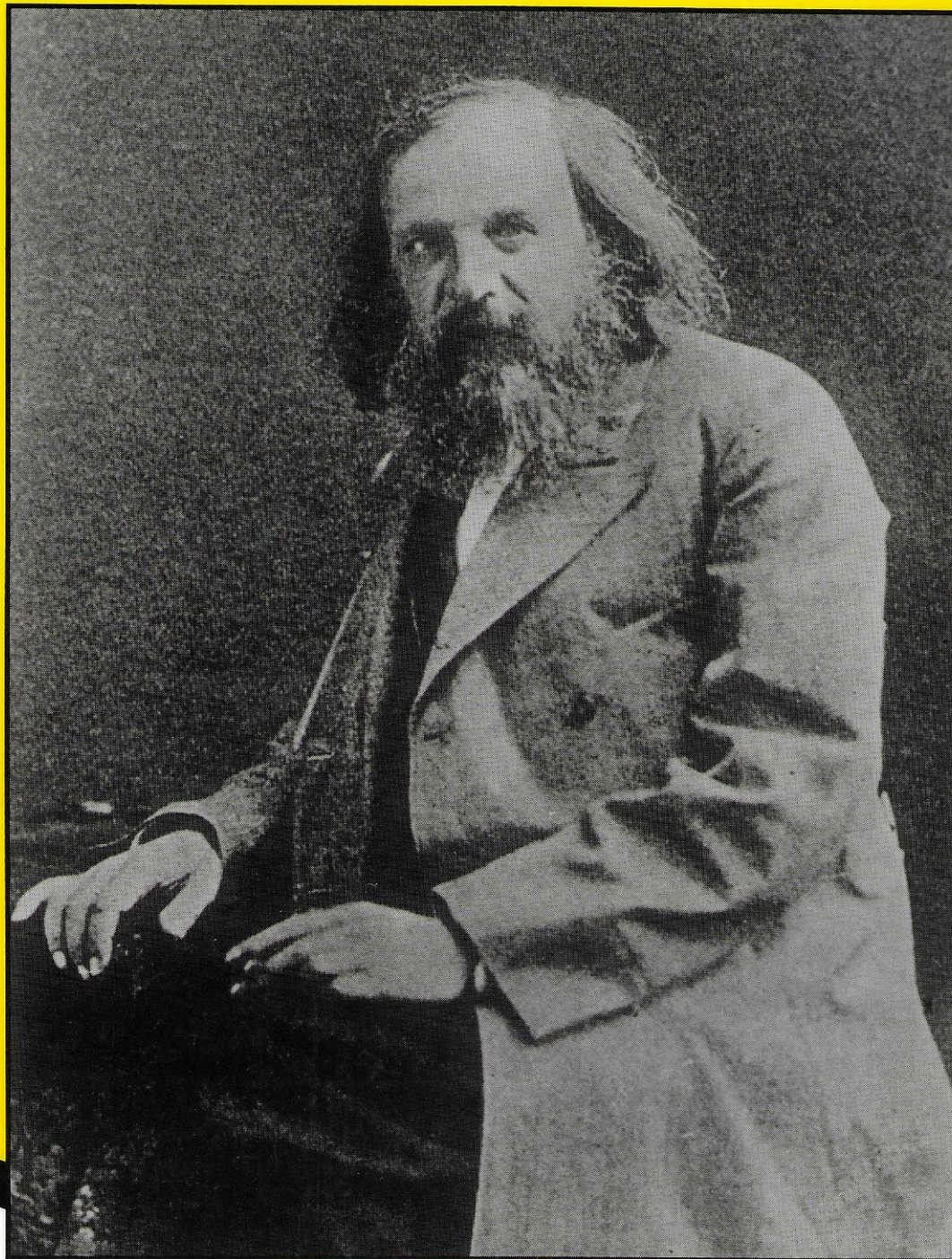
SCIENCE



Units 11-12
Atomic structure



SCIENCE



Units 13-14
Chemical reactions
and the Periodic Table

I II

87 88 89-102 103 104 105

Fr Ra actinides Lr

transition elements

typical elements

lanthanides

57 58 59 60 61 62 63 64 65 66 67 68 69 70
La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb

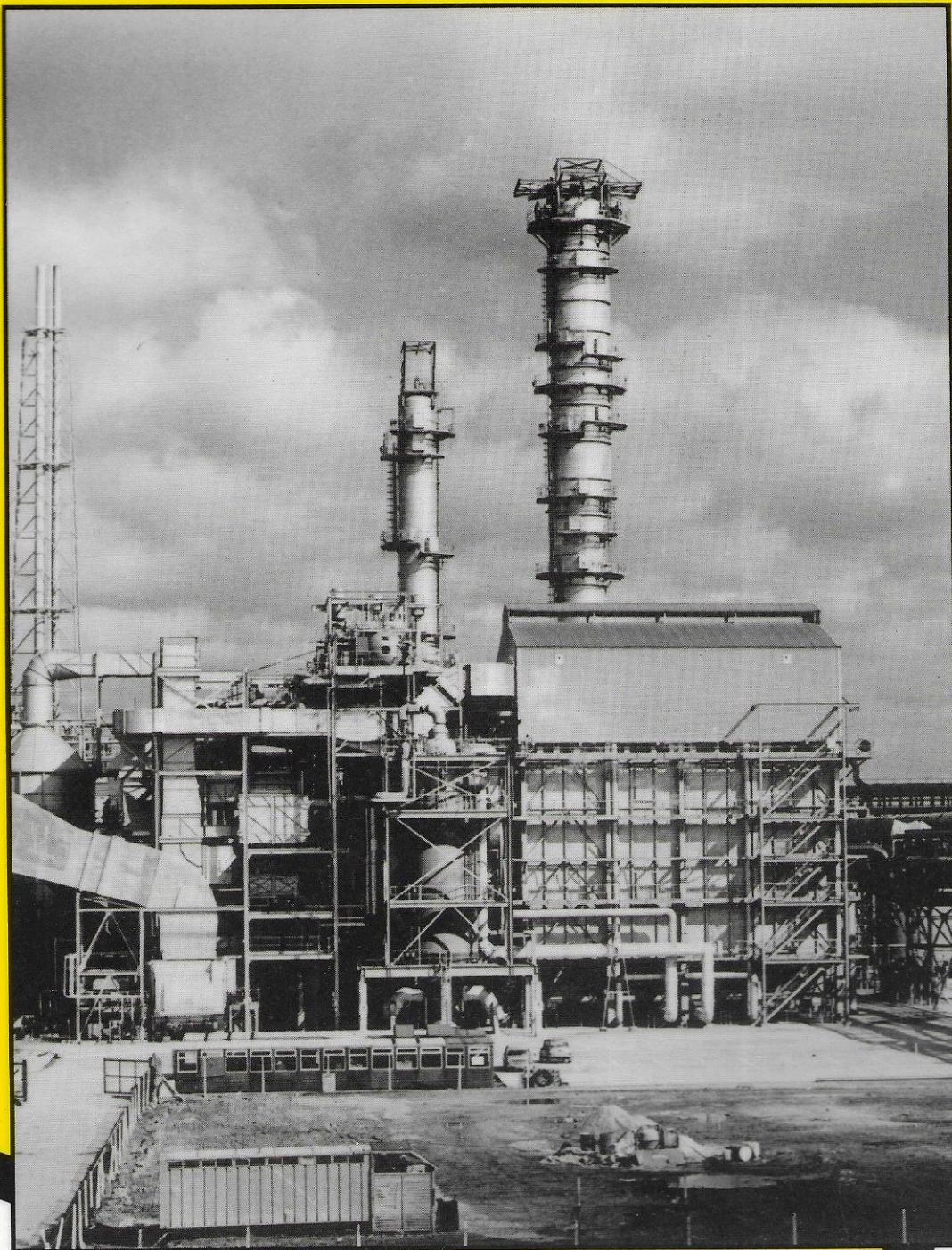
89 90 91 92 93 94 95 96 97 98 99 100 101 102
Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No

actinides

1	Science and the planet Earth	19	Life and evolution
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SCIENCE



Unit 15
Chemical equilibrium

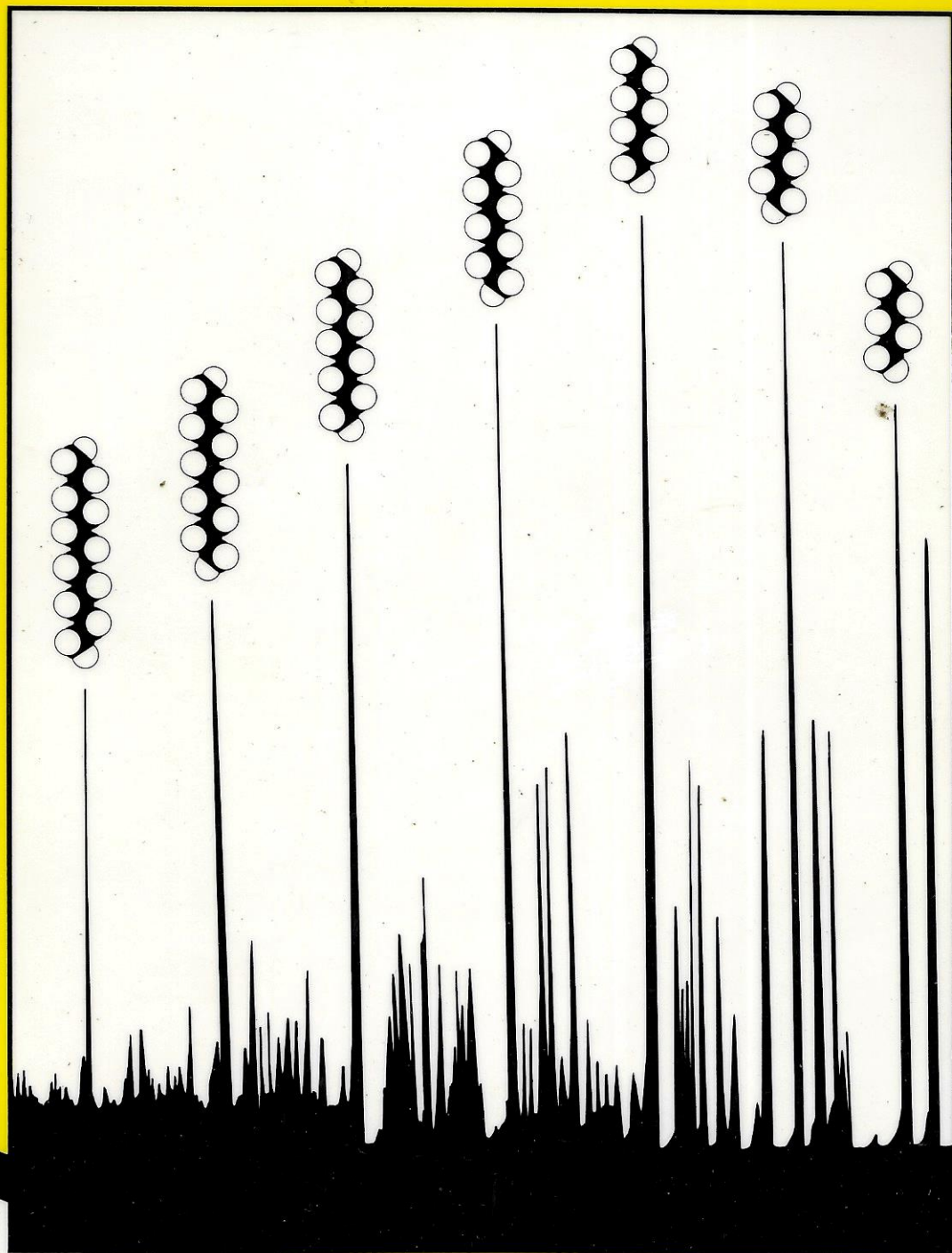
Unit 16
Chemical energetics

[illegible]

1	Science and the planet Earth	19	Life and evolution
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SCIENCE



Units 17-18
The chemistry of
carbon compounds

[illegible]

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SCIENCE



Unit 19
Life and evolution

Unit 20
Inheritance and cell division

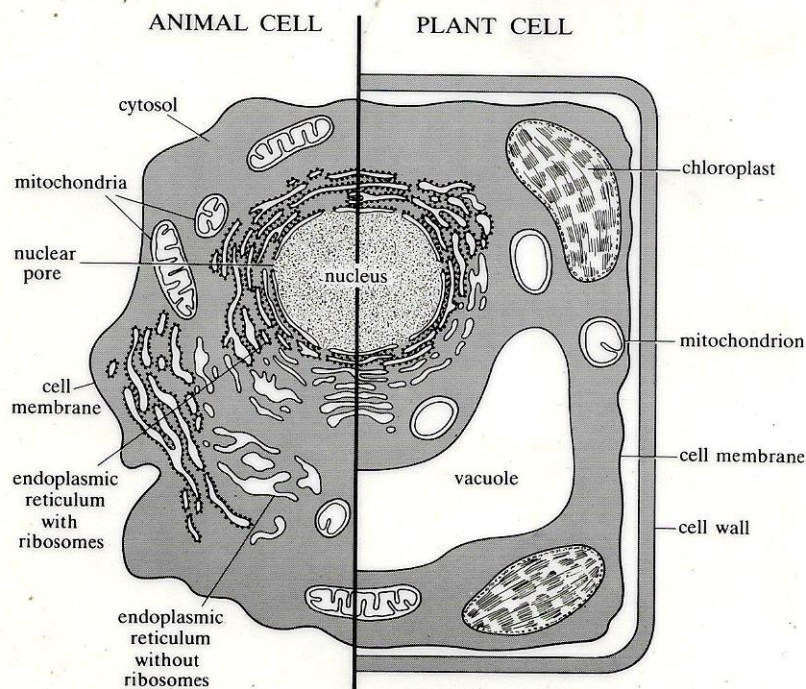
Unit 21
Genes and evolution

USEFUL INFORMATION FOR THE BIOLOGY UNITS: CHEMICALS, CELLS AND CLASSIFICATION

All cellular organisms contain these four biopolymers (made up of the monomers shown below).

Biopolymers:	polysaccharides	proteins	DNA	RNA
Monomers:	monosaccharides	amino acids	deoxyribonucleotides	ribonucleotides

All eukaryotic organisms have cells of the following generalized structure.



All living organisms can be divided into four kingdoms. The figures in brackets show the number of species (in thousands) in each subkingdom.

Animals	Plants	Fungi	Prokaryotes
sponges (4)	eukaryotic algae (20)	slime moulds (0.5)	bacteria (1.6)
unicells (40)	true plants (330)	true fungi (100)	blue-green bacteria
multicells (1 000–2 000)			(formerly termed blue-green algae). (1.5)

SI02 UNITS

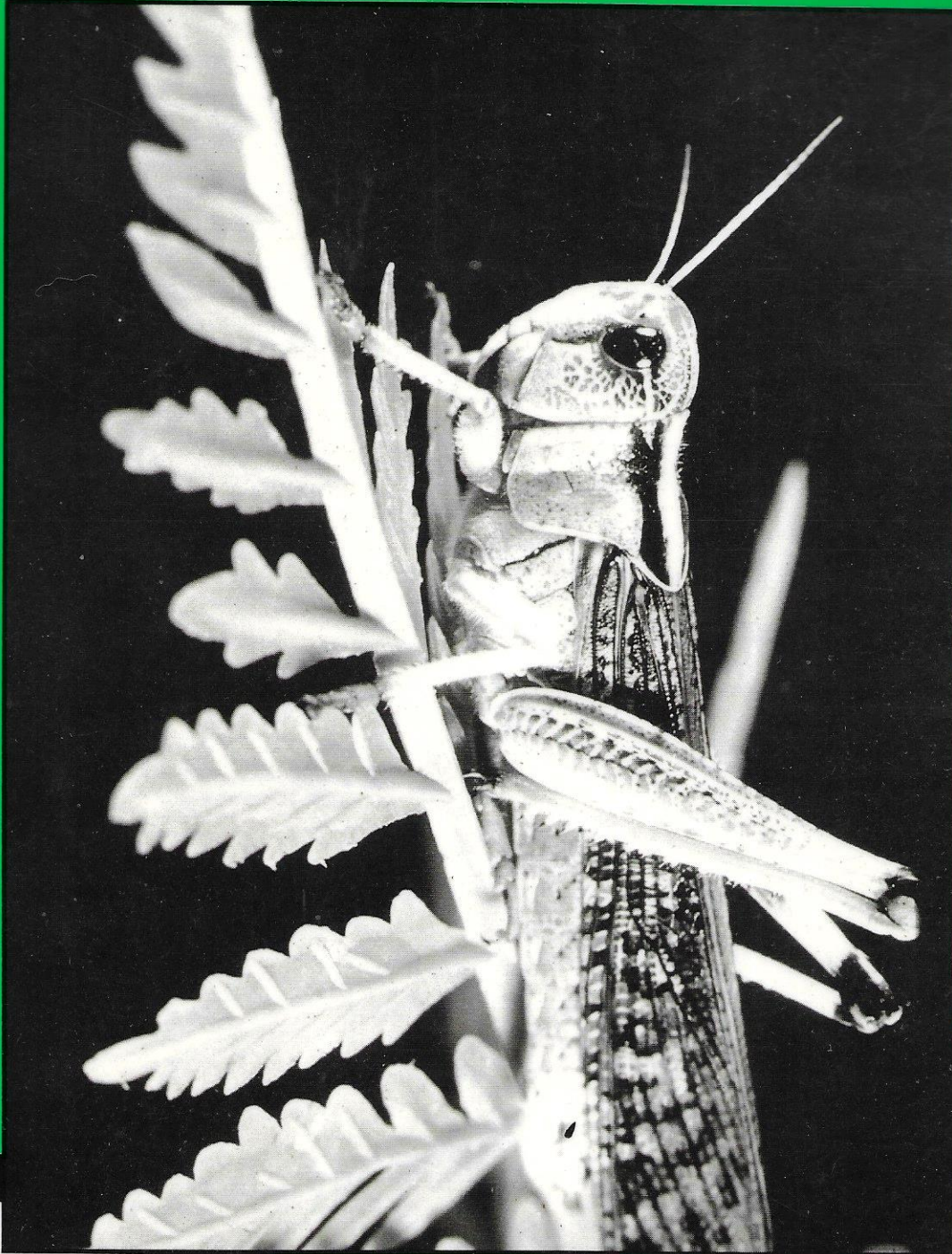
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SI02 UNITS 22 AND 23

THE OPEN UNIVERSITY
SI02: A SCIENCE FOUNDATION COURSE



SCIENCE



Unit 22
Biochemistry

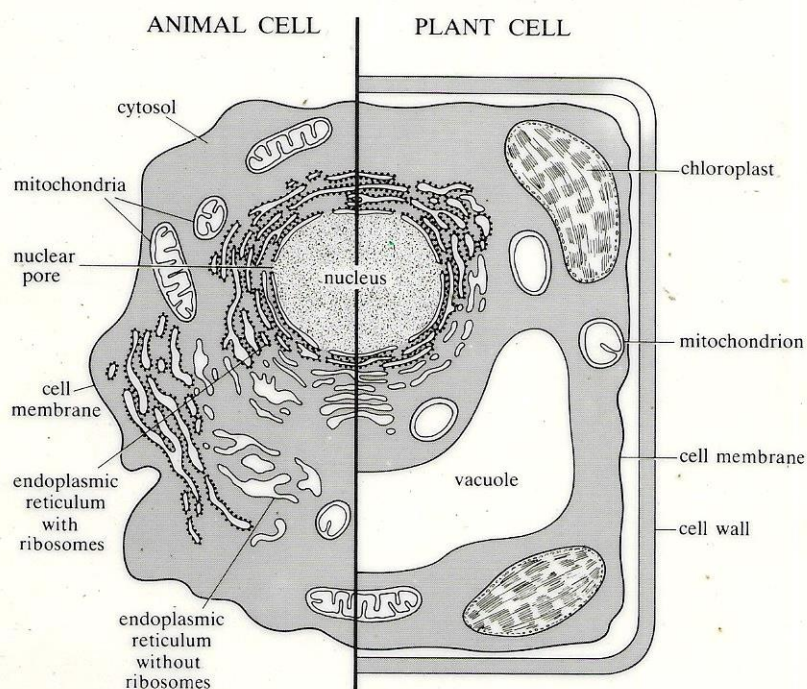
Unit 23
Physiology

USEFUL INFORMATION FOR THE BIOLOGY UNITS: CHEMICALS, CELLS AND CLASSIFICATION

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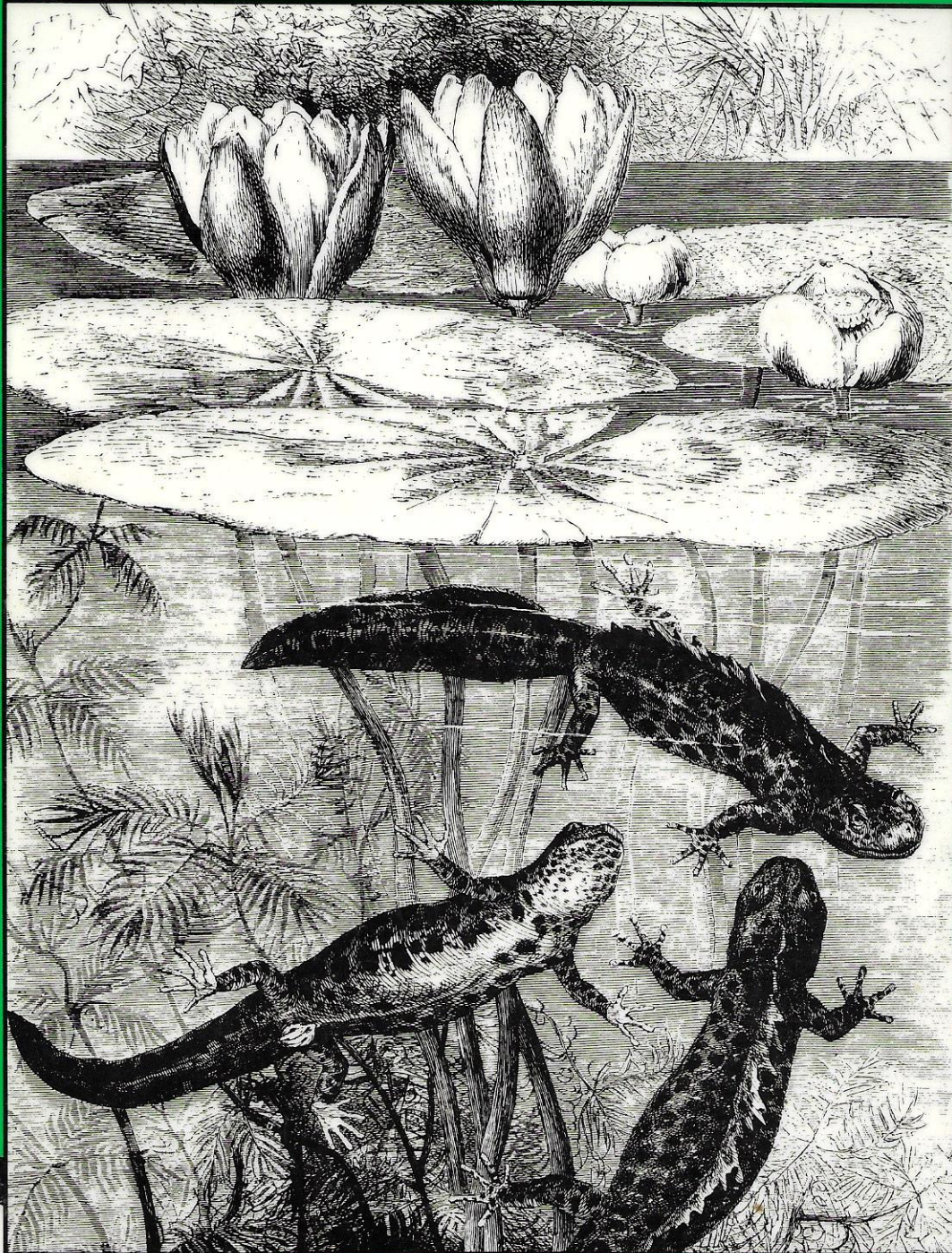
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(1 000–2 000)			(1.5)

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SCIENCE



Unit 24
DNA: molecular
aspects of genetics

Unit 25
Ecology

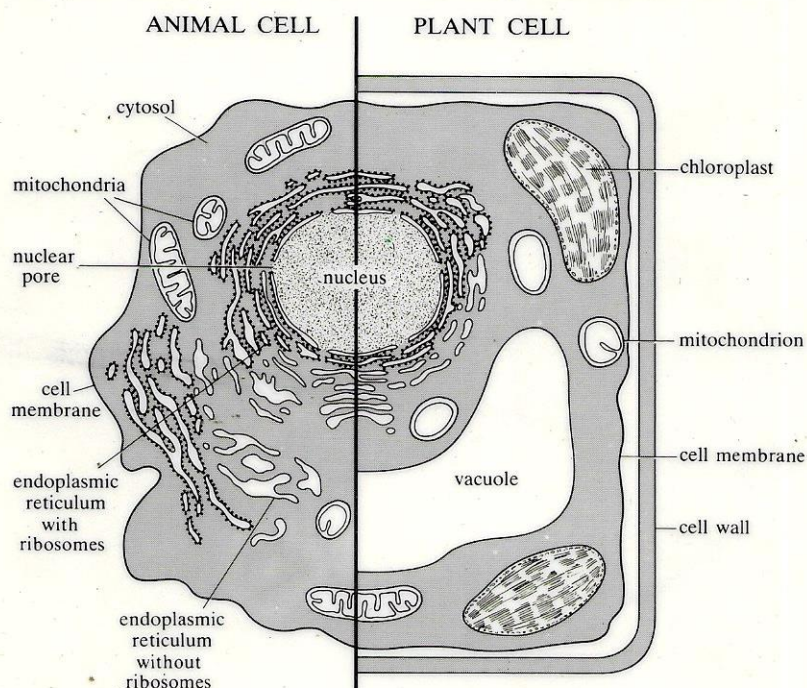
Unit 26
Biology reviewed

USEFUL INFORMATION FOR THE BIOLOGY UNITS: CHEMICALS, CELLS AND CLASSIFICATION

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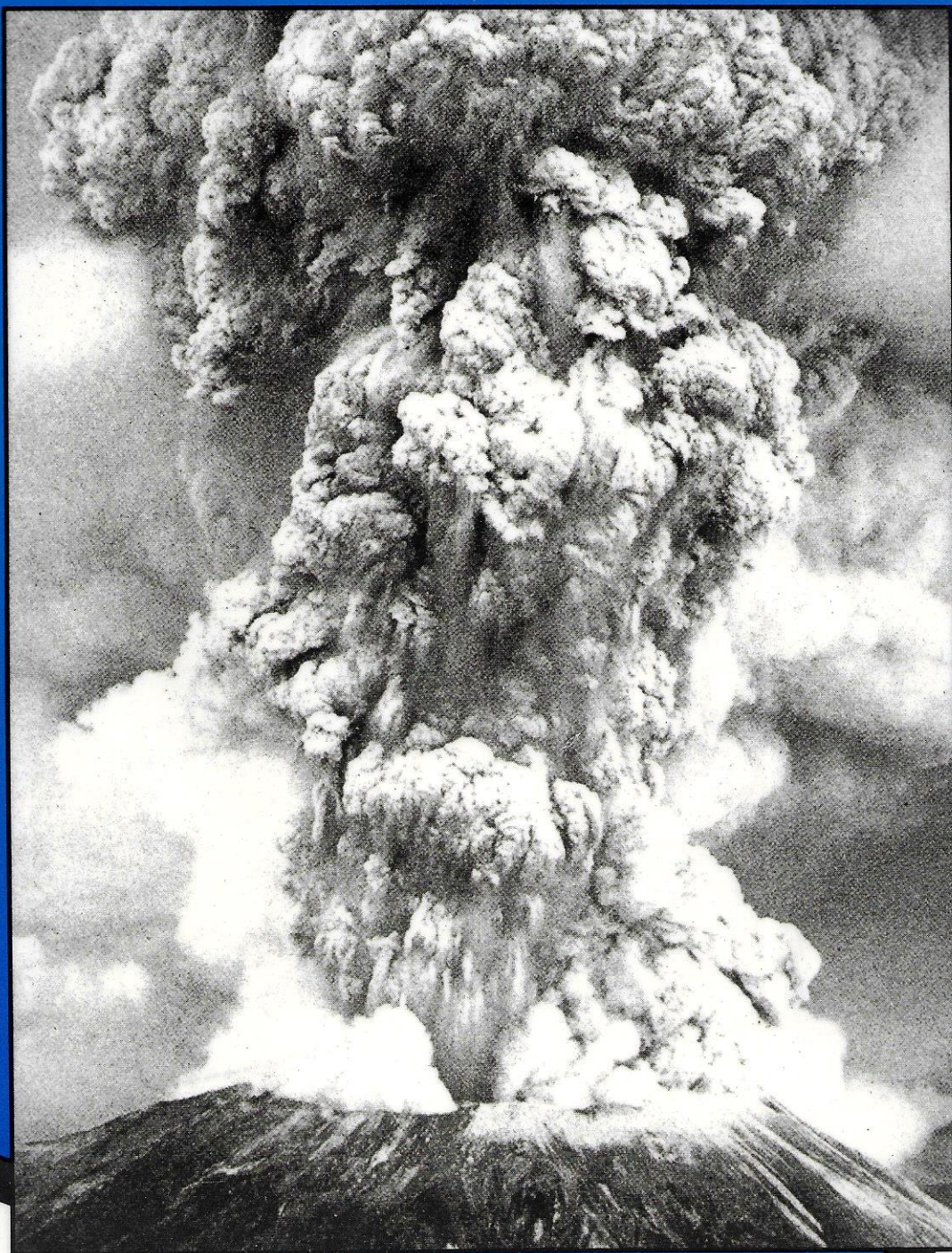
Animals	Plants	Fungi	Prokaryotes
sponges (4)	eukaryotic algae (20)	slime moulds (0.5)	bacteria (1.6)
unicells (40)	true plants (330)	true fungi (100)	blue-green bacteria
multicells (1 000–2 000)			(formerly termed blue-green algae)
			(1.5)

SI02 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
3	Motion under gravity	21	Genes and evolution
4	Practical work in science	22	Biochemistry
5–6	Into the Earth: earthquakes, seismology and the Earth's magnetism	23	Physiology
7–8	Plate tectonics: a revolution in the Earth sciences	24	DNA: molecular aspects of genetics
9	Energy	25	Ecology
10	Modelling the behaviour of light	26	Biology reviewed
11–12	Atomic structure	27	Earth materials and processes
13–14	Chemical reactions and the Periodic Table	28–29	Geological time and Earth history
15	Chemical equilibrium	30	Quantum mechanics: an introduction
16	Chemical energetics	31	Quantum mechanics: atoms and nuclei
17–18	The chemistry of carbon compounds	32	The search for fundamental particles



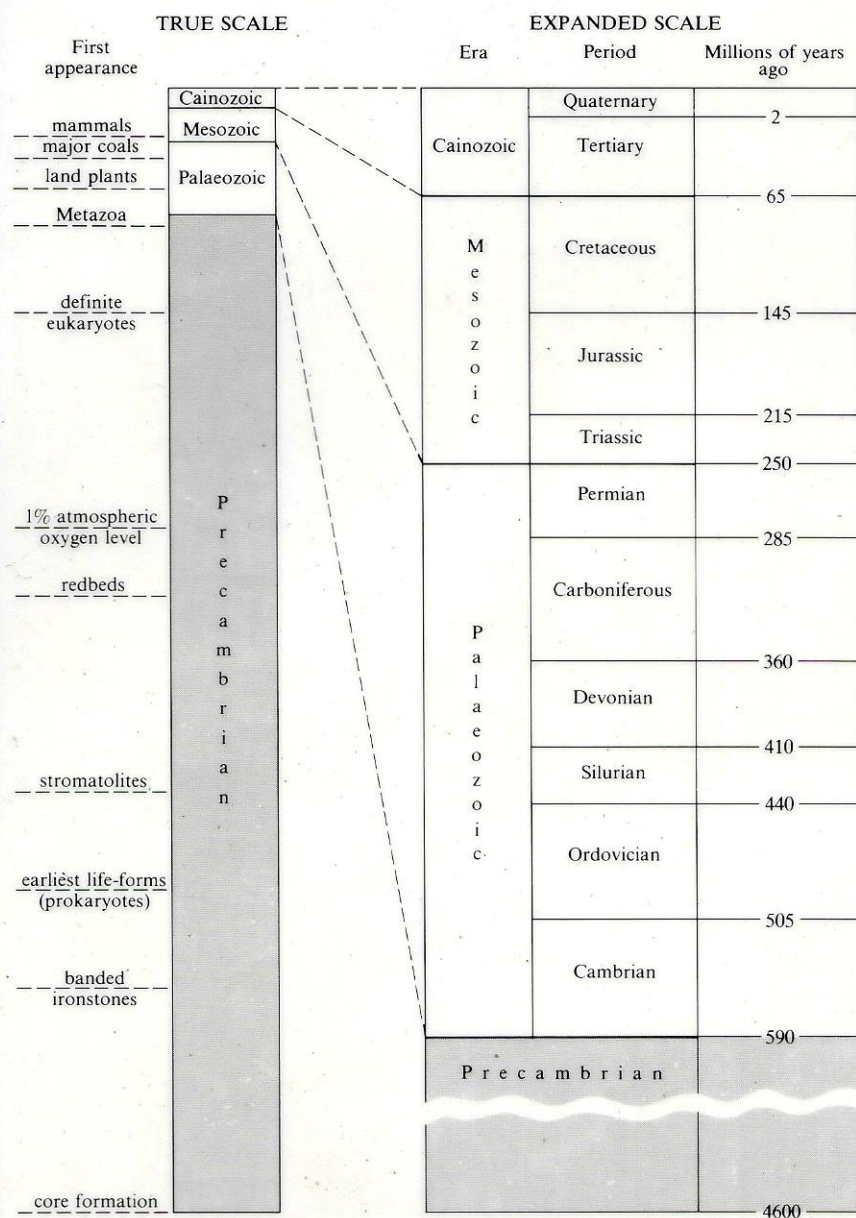
SCIENCE



Unit 27
Earth materials and processes

Units 28 – 29
Geological time and Earth history

EARTH HISTORY AND STRATIGRAPHIC COLUMN

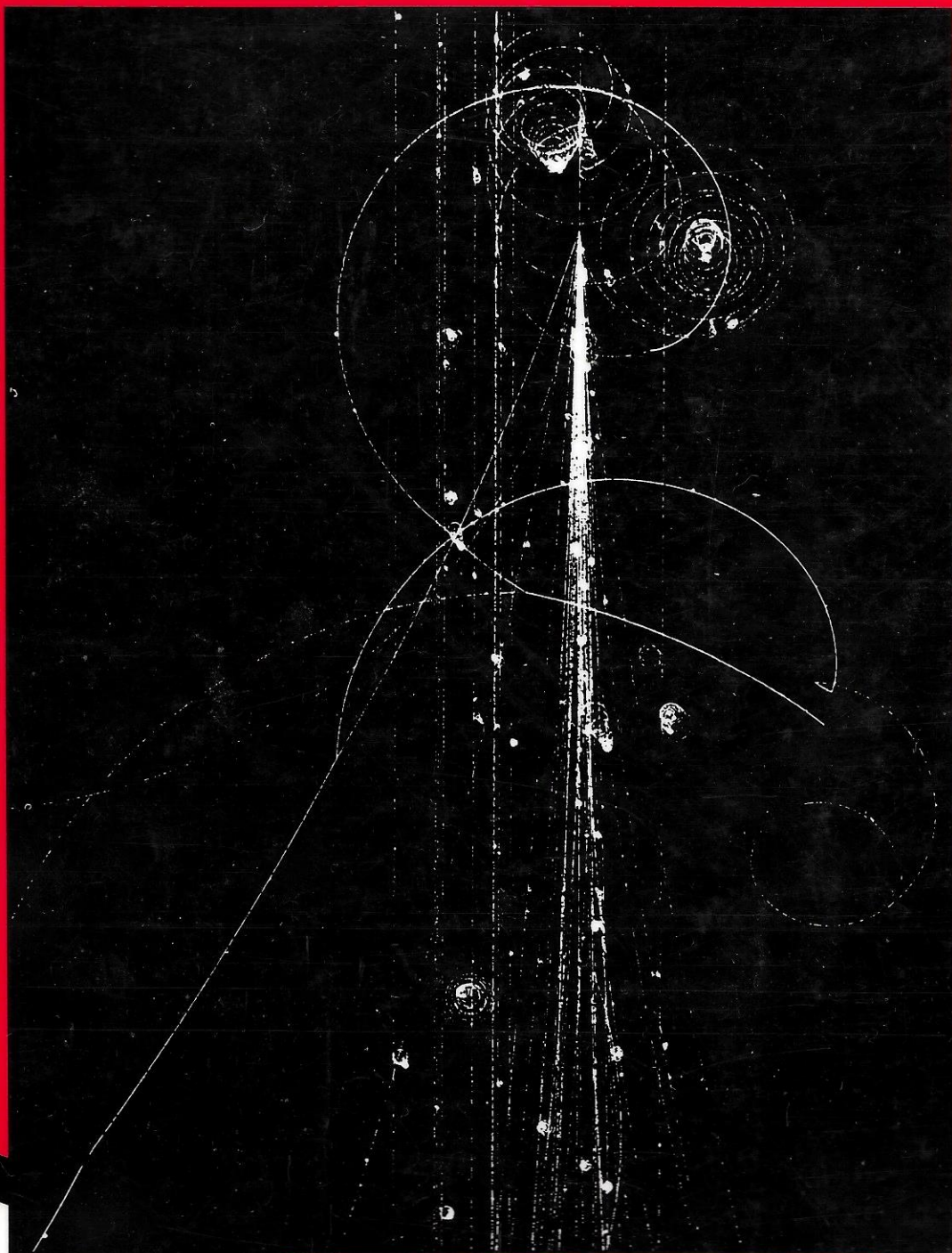


SI02 UNITS

1	Science and the planet Earth	19	Life and evolution
2	Measuring the Solar System	20	Inheritance and cell division
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4	Practical work in science	22	Biochemistry
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16	Chemical energetics	31	Quantum mechanics: atoms and nuclei
17-18	The chemistry of carbon compounds	32	The search for fundamental particles



SCIENCE



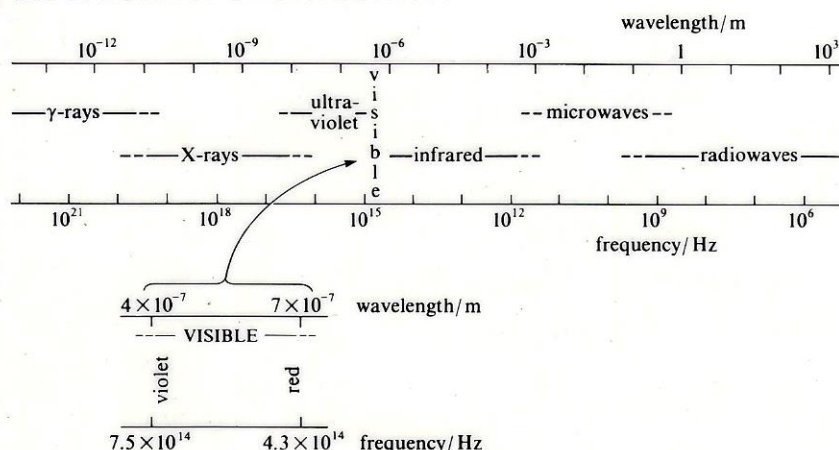
Unit 30
Quantum mechanics:
an introduction

Unit 31
Quantum mechanics:
atoms and nuclei

Unit 32
The search for fundamental particles

USEFUL INFORMATION FOR THE PHYSICS AND GENERAL SCIENCE UNITS

ELECTROMAGNETIC SPECTRUM



PHYSICAL CONSTANTS

Symbol	Quantity	Approximate value
G	gravitational constant	$6.672 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
c	speed of light in a vacuum	$2.998 \times 10^8 \text{ m s}^{-1}$
h	Planck's constant	$6.626 \times 10^{-34} \text{ J s}$
e	magnitude of the charge of the electron	$1.602 \times 10^{-19} \text{ C}$
m_e	mass of the electron	$9.110 \times 10^{-31} \text{ kg}$
m_n	mass of the neutron	$1.675 \times 10^{-27} \text{ kg}$
m_p	mass of the proton	$1.673 \times 10^{-27} \text{ kg}$

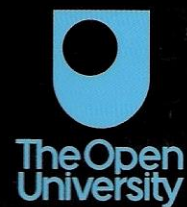
USEFUL QUANTITIES AND CONVERSIONS

$\pi \approx 3.142$	Earth radius (equatorial) $\approx 6.38 \times 10^6 \text{ m}$
1 mile $\approx 1.609 \text{ km}$	circumference of the Earth (distance round the Equator) $\approx 4.01 \times 10^7 \text{ m}$
1 kilometre (km) $\approx 0.6214 \text{ mile}$	radius of the Moon $\approx 1.74 \times 10^6 \text{ m}$
1 inch = 2.54 cm	radius of the Sun $\approx 6.96 \times 10^8 \text{ m}$
1 centimetre (cm) $\approx 0.3937 \text{ inch}$	Earth-Sun distance (i.e. orbital radius of the Earth) $\approx 1.50 \times 10^{11} \text{ m}$
1 kilocalorie $\approx 4187 \text{ J}$	Earth-Moon distance (i.e. orbital radius of the Moon) $\approx 3.84 \times 10^8 \text{ m}$
1 electronvolt (eV) $\approx 1.602 \times 10^{-19} \text{ J}$	
1 radian $\approx 57.296 \text{ degrees}$	
1 degree $\approx 0.01745 \text{ radian}$	
1 GeV/ $c^2 \approx 1.783 \times 10^{-27} \text{ kg}$	

SI02 UNITS

1	Science and the planet Earth	19	Life and evolution
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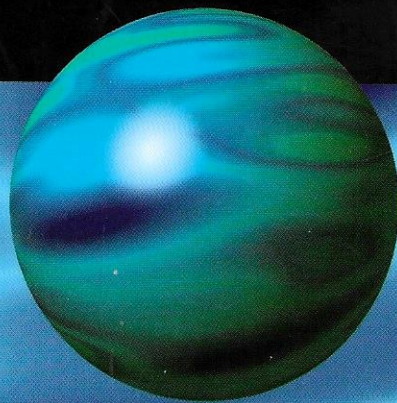
Block 1
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Water for life



- 1 Water for life**
- 2 A temperate Earth?**
- 3 The Earth and its place
in the Universe**
- 4 Unity within diversity**
- 5 Energy**
- 6 Our world and its atoms**
- 7 The quantum world**
- 8 Building with atoms**
- 9 Continuity and change**
- 10 Earth and life through time**
- 11 Universal processes**
- 12 Life in the Universe**



Block 2
S103 Science: A Level One Course

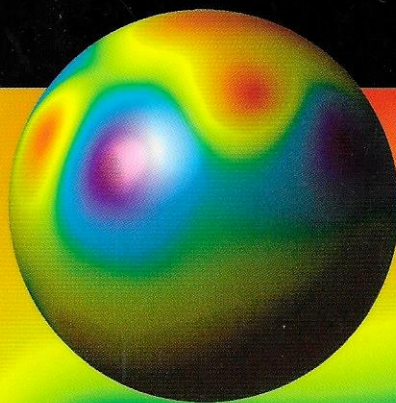
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A temperate Earth?

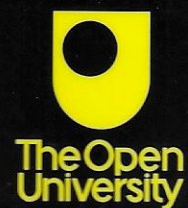
2

- 1 Water for life**
- 2 A temperate Earth?**
- 3 The Earth and its place
in the Universe**
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- 6 Our world and its atoms**
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- 12 Life in the Universe**



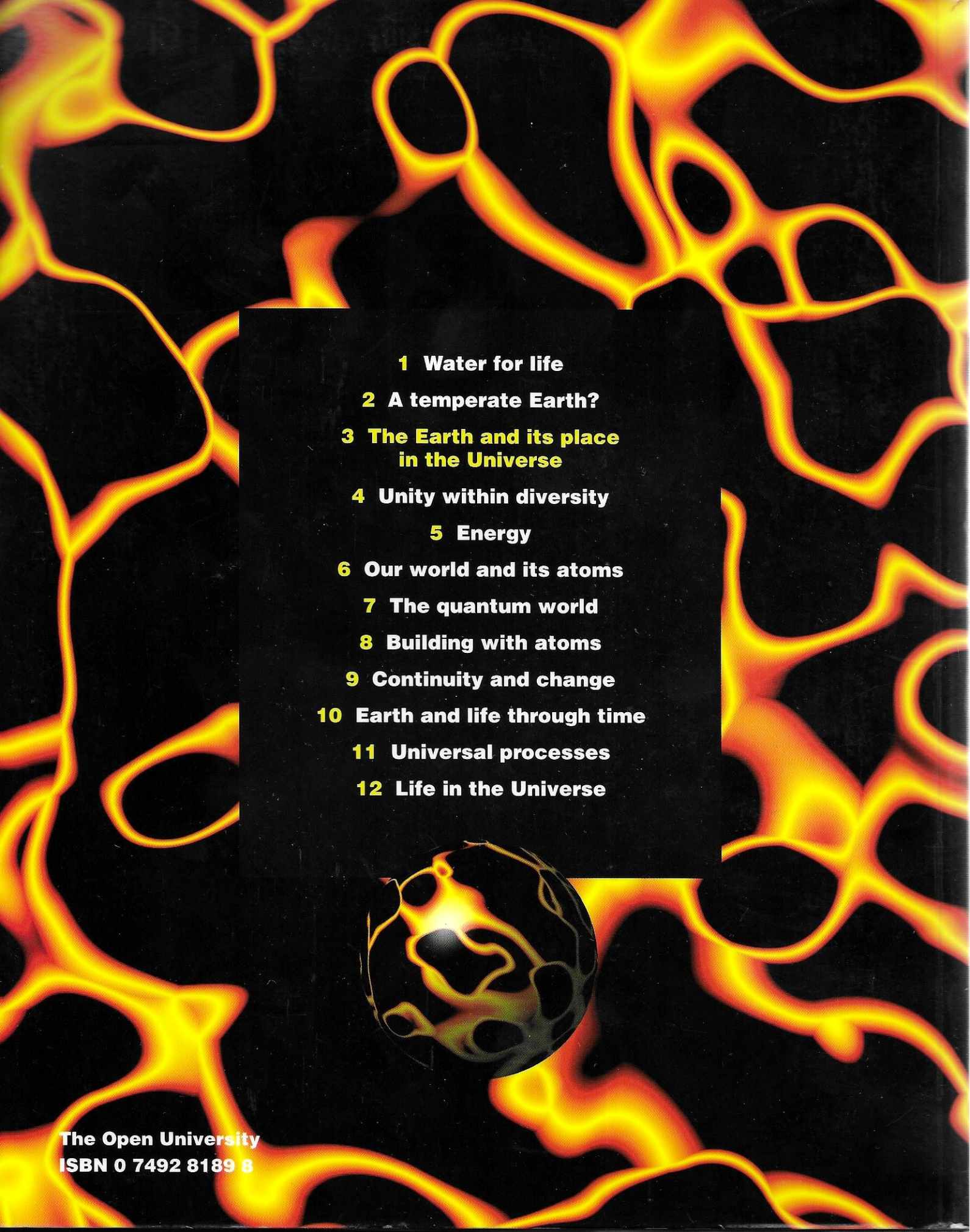
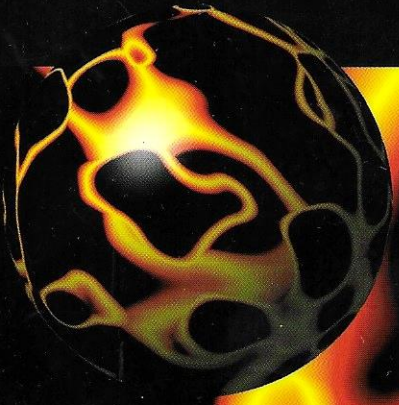
Block 3
S103 Science: A Level One Course

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**The Earth and its place in
the Universe**

3

- 
- 
- 1 Water for life**
 - 2 A temperate Earth?**
 - 3 The Earth and its place
in the Universe**
 - 4 Unity within diversity**
 - 5 Energy**
 - 6 Our world and its atoms**
 - 7 The quantum world**
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 - 9 Continuity and change**
 - 10 Earth and life through time**
 - 11 Universal processes**
 - 12 Life in the Universe**

Block 4
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Unity within diversity

4

- 
- 1 Water for life**
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 - 3 The Earth and its place in the Universe**
 - 4 Unity within diversity**
 - 5 Energy**
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 - 7 The quantum world**
 - 8 Building with atoms**
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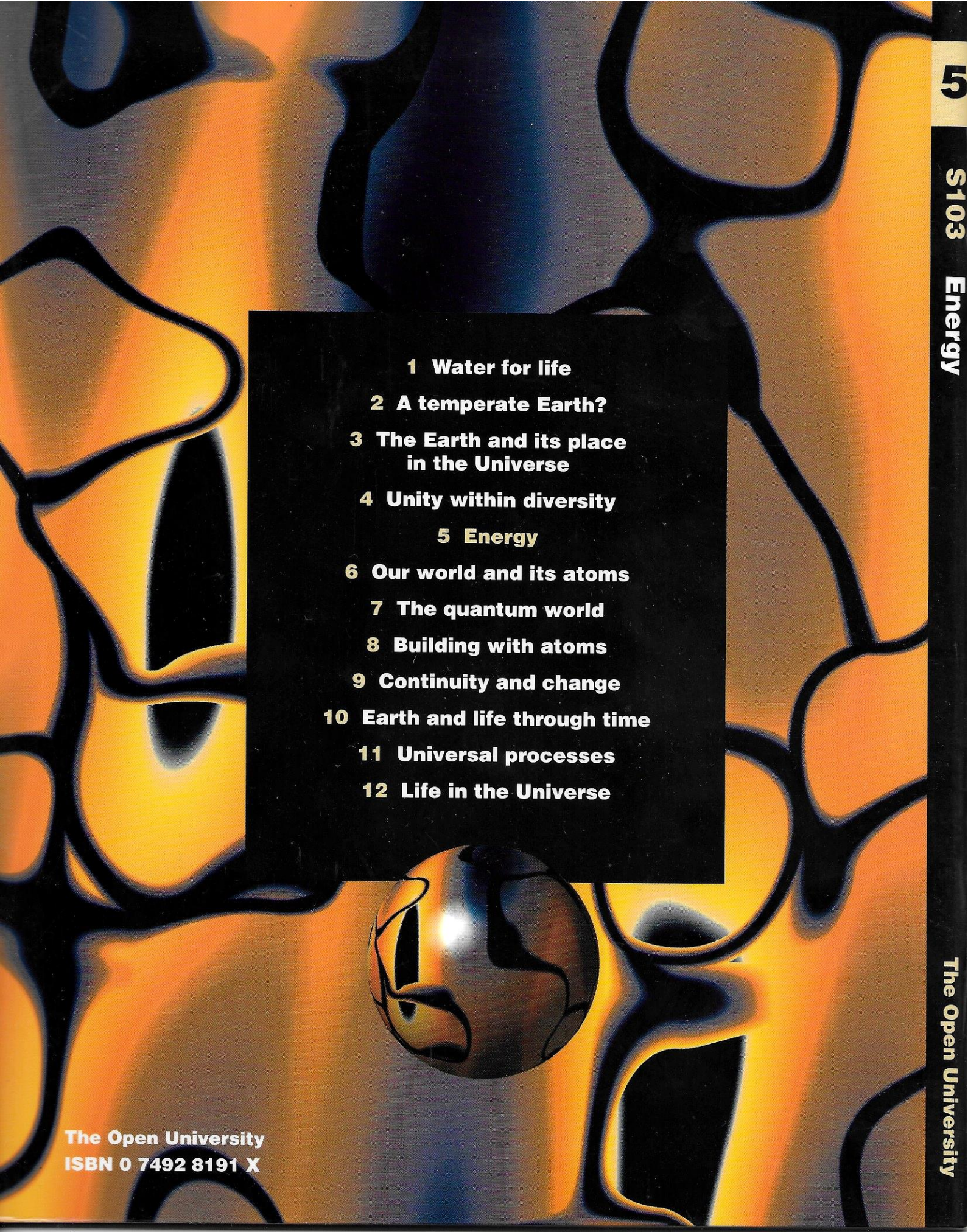
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5 Energy

- 
- 1 Water for life**
 - 2 A temperate Earth?**
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 - 5 Energy**
 - 6 Our world and its atoms**
 - 7 The quantum world**
 - 8 Building with atoms**
 - 9 Continuity and change**
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 - 11 Universal processes**
 - 12 Life in the Universe**

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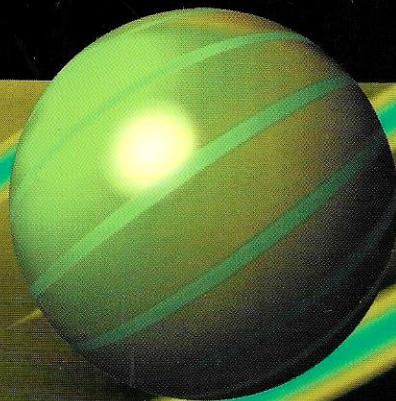
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Our world and its atoms

6

- 1 Water for life**
- 2 A temperate Earth?**
- 3 The Earth and its place
in the Universe**
- 4 Unity within diversity**
- 5 Energy**
- 6 Our world and its atoms**
- 7 The quantum world**
- 8 Building with atoms**
- 9 Continuity and change**
- 10 Earth and life through time**
- 11 Universal processes**
- 12 Life in the Universe**



Block 7
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7 The quantum world

- 
- 
- 1 Water for life**
 - 2 A temperate Earth?**
 - 3 The Earth and its place in the Universe**
 - 4 Unity within diversity**
 - 5 Energy**
 - 6 Our world and its atoms**
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Block 8
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Building with atoms


8

- 
- 1 Water for life**
 - 2 A temperate Earth?**
 - 3 The Earth and its place in the Universe**
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 - 5 Energy**
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 - 7 The quantum world**
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 - 12 Life in the Universe**



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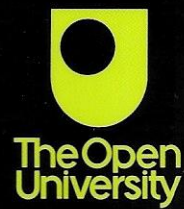

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9 Continuity and change

- 
- 
- 1 Water for life**
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 - 3 The Earth and its place in the Universe**
 - 4 Unity within diversity**
 - 5 Energy**
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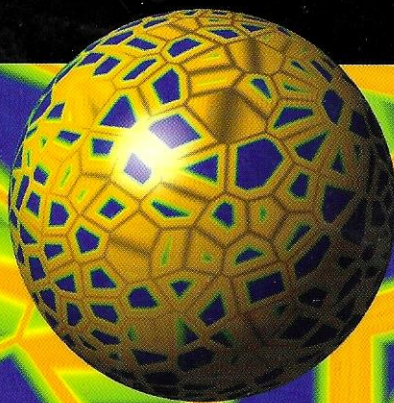
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Earth and life through time

10

- 
- 1 Water for life**
2 A temperate Earth?
**3 The Earth and its place
in the Universe**
4 Unity within diversity
5 Energy
6 Our world and its atoms
7 The quantum world
8 Building with atoms
9 Continuity and change
10 Earth and life through time
11 Universal processes
12 Life in the Universe



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Universal processes

11

- 
- The background of the entire page is a vibrant cosmic scene featuring several bright, glowing yellow and orange galaxies or nebulae scattered across a deep purple and black space. A network of thin, golden-yellow lines, resembling lightning or cosmic filaments, crisscrosses the entire background. In the center of the page, there is a large, solid black rectangular box. Inside this box, a table of contents is listed in white and purple text. At the bottom center of the page, below the black box, is a small, dark, spherical object with a textured surface that appears to have glowing orange and yellow spots, possibly representing a planet or a celestial body.
- 1 Water for life**
 - 2 A temperate Earth?**
 - 3 The Earth and its place in the Universe**
 - 4 Unity within diversity**
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 - 6 Our world and its atoms**
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 - 12 Life in the Universe**



Practising science study book



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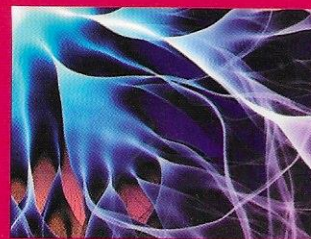
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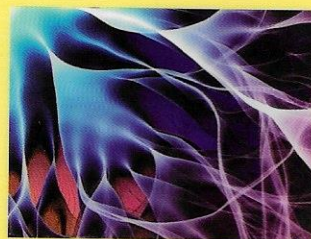


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Energy and Light





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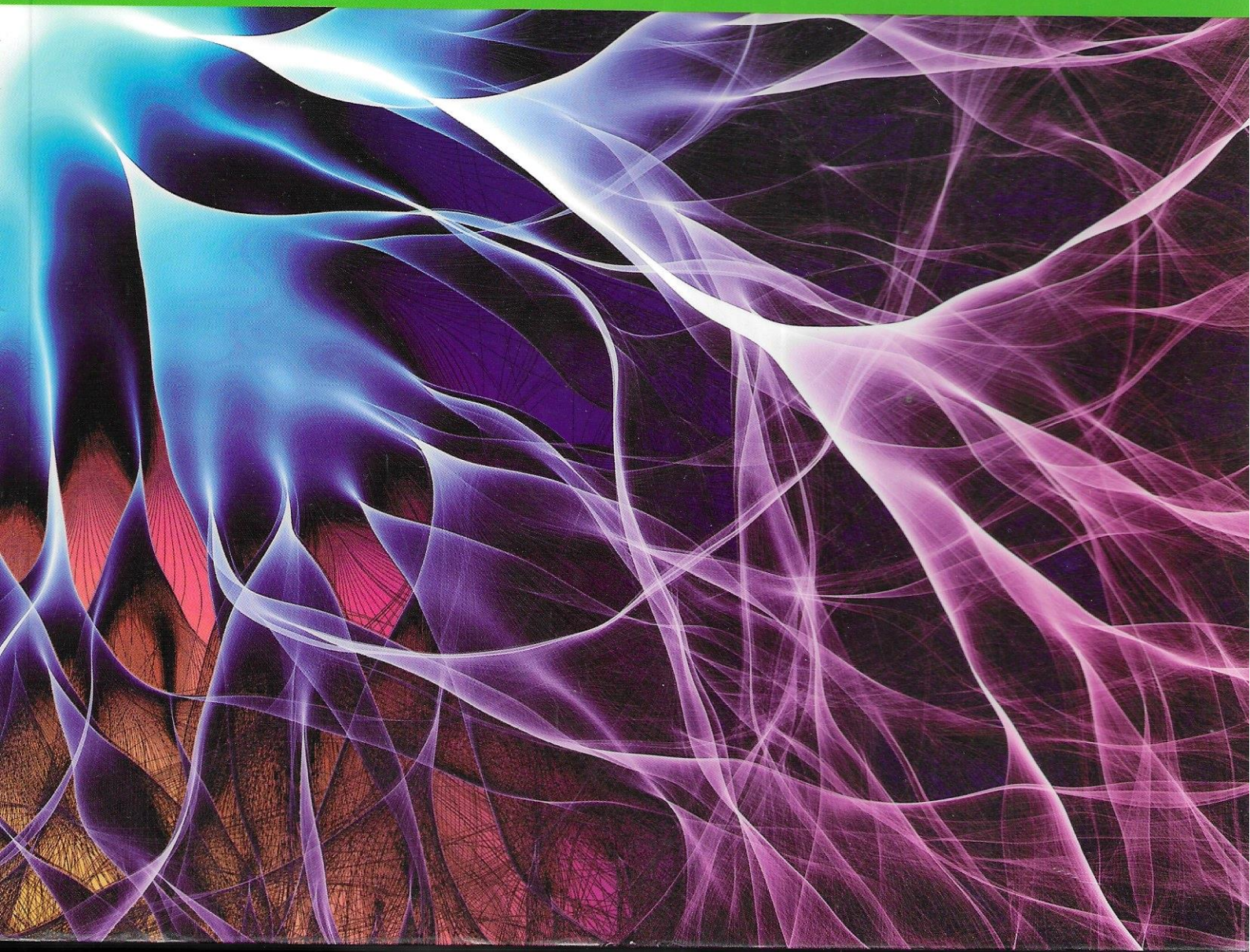
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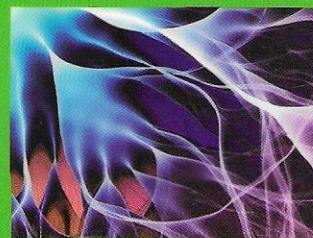
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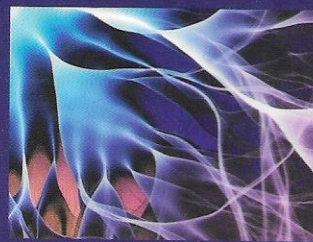
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Exploring Earth's History











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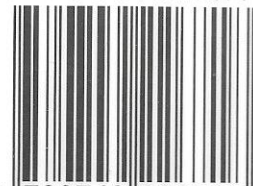


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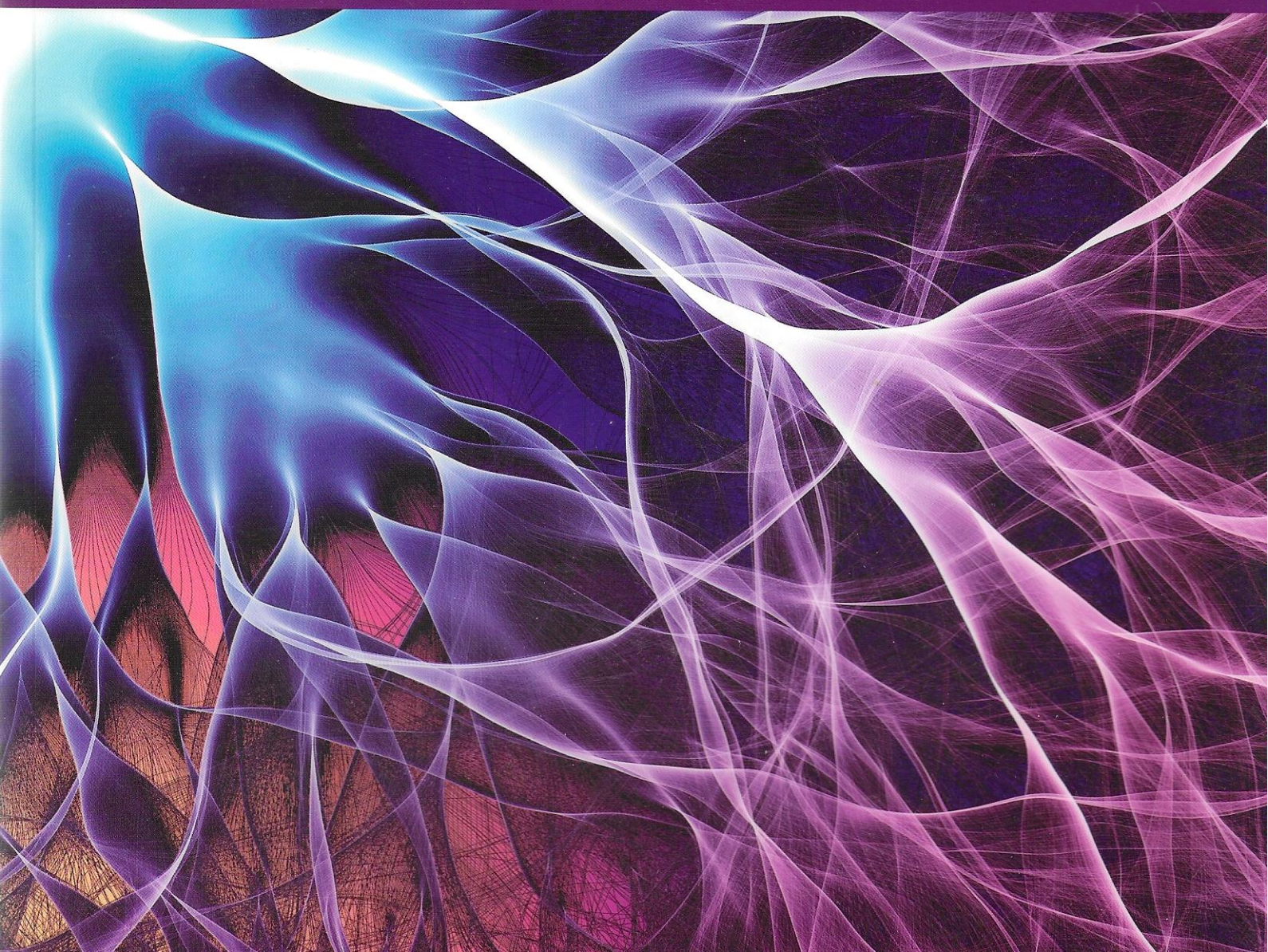
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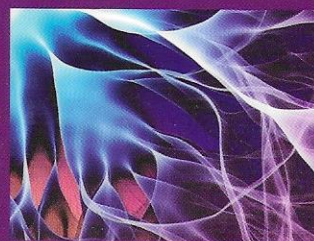
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Fossils and the History of Life